ANACONDA COPPER COMPANY
NEW MEXICO OPERATIONS

# ANNUAL RECLAMATION REPORT FOR 1978

The Anaconda Copper Company conducted mining and reclamation activities on the Jackpile-Paguate Mine, Pueblo of Laguna Uranium Leases 1, 4 and 8, Laguna Indian Reservation, Townships 10 and 11 North, Range 5 West, NMPM, Valencia County, New Mexico, during the 1978 calendar year.

Mining operations on the Laguna lease were conducted in both underground and open pit mines, and surface drilling activity was conducted in areas adjacent to all mines. Reclamation work was done on completed waste dump surfaces as described in this report.

The status of mining activity at the end of 1977 is shown on the Surface Activity for 1977 - Base Map. Surface Activity for 1978 (Sheet 1) shows mining, stripping and ore stockpiling activity as of December 31, 1978. Surface Activity for 1978 (Sheet 2) shows waste, stripping, backfill areas and topsoil stockpiling as of December 31, 1978. Areas of reclamation, as described in this report, are shown on Sheet 2.

The underground mines which were operated during 1978 were the P-10/7 and PW-2/3, from which a total of 300,449 tons were mined. This consisted of 246,468 tons of ore and 53,981 tons of discard that was disposed of in an existing waste dump. No additional ground surface disturbance was caused by underground mining operations during 1978.

Open pit mining operations during 1978 were conducted in five areas in the Jackpile and Paguate mines from which 35,113,972 tons of ore and discard were mined. The ore was handled through thirteen active stockpiles that were established prior to 1978 to receive ore from the mining operations and

from which shipments to mill process were made.

Of the total discard, 64% (21,419,069 tons) was backfilled in four major mined-out areas (105 acres), 1% (216,000 tons) was placed on one existing waste dump, 26% (8,926,406 tons) was placed on three new dumps (82 acres), and 9% (2,885,200 tons) went into two topsoil stockpiles for future use in reclamation work, of which 1,011,900 tons were placed on an existing stockpile and 1,873,300 tons were placed on a new stockpile on 21 acres.

The new areas affected by the open pit mining operations in 1978 were in the Jackpile and Paguate mines and their immediate vicinities. The land was affected by the disturbance of 107 acres by excavation, 82 acres by waste dumps and 21 acres by temporary topsoil stockpiles. A total of 123 acres were reclaimed in 1978.

SUMMARY OF SURFACE OPERATION

1. Stripping:

   (a) Total Tonnage = 23,527,997 tons
   (b) Acres Disturbed = 107 acres.

2. Mining:

   (a) Tons Ore = 1,667,297 tons
   (b) Tons Protore = 1,338,776 tons
   (c) Tons Mining Waste = 8,579,902 tons
   (d) Total Mining - 11,585,975 tons.

3. Open Pit Excavation:

   (a) Total = 35,113,972 tons

4. Tonnage to Waste Dumps:

   (a) Existing = 216,000 tons

(b) New Dumps = 8,926,406 tons
(c) Acres Disturbed by New Dumps = 82 acres*

5. Tonnage to Backfill:

(a) Jackpile = 6,115,893 tons
(b) Paguate = 13,964,400 tons
(c) Acres Backfilled--Jackpile Pit = 56 acres*
(d) Acres Backfilled--Paguate Pit = 49 acres*

6. Total Ore & Protore Stockpiling:

(a) Tons Stockpiled = 3,006,073 tons
(b) No New Acreage Disturbed.

7. Ore Shipped for Processing:

(a) Total = 1,769,883 tons

8. Ore Remaining in Stockpile:

(a) Total = 1,236,190 tons

9. Topsoil Stockpiling:

(a) Paguate = 1,011,900 tons to existing pile
(b) Jackpile = 1,873,300 tons to new stockpile
(c) Acres Disturbed by New Stockpile = 21 acres*

10. Reclamation:

(a) Acres Prepared (graded & topdressed) = 123 acres

(* NOTE: For site locations refer to the Surface Activity 1978 Map, Sheet 2)

The Anaconda Company's reclamation program at the Jackpile-Paguate mine began in full force in 1976. The primary objective of the program is to rehabilitate waste dumps, open pits, ground surfaces presently covered by ore stockpiles, roads and storage areas for use as productive rangeland. The following information describes locations prepared for revegetation and the stabilization technique implemented. This report includes reclamation work

completed in 1978 and also an update on all past reclamation done at the Jackpile-Paguate Mine. Research work concerning methods of slope stabilization is also included.

Backfill

The locations that have been backfilled are shown on Surface Activity for 1978 (Sheet 2). The volumes that have been filled in the Paguate Pit are filled up through the Jackpile formation. The figures given below are total tons backfilled as of December 31, 1978.

| AREA | Tons of Material Backfilled to Year-end 1978 |
|---|---|
| Jackpile Pit | 30,277,300 |
| Paguate Pit (north and south) | 26,955,424 |

Stabilizing Technique (1978)

The existing cover on Dumps L and K (refer to 1978 Surface Activity Map for site locations) is primarily Tres Hermanos sandstone, and soil analysis displayed no phytotoxic properties in this material. The surface and slopes were prepared by bulldozers and graders. Small amounts of soil were hauled in by scraper to cover the access ramp and construct water catchment berms. Large rocks were pushed into piles creating habitat for small birds and mammals.

Portions of Dumps X, I and $Y_2$ (approximately 70 acres) are presently being prepared for seeding. Soil is being transported onto the site from an adjacent dump where favorable material was located. Soil analysis of this material revealed no phytotoxic properties. The seedbed is still under

construction and the erosion control system will be completed near the first of the year.

Slopes (1978)

Landscape surrounding the Jackpile mine contains steep, sometimes vertical, slopes that support little vegetation. Many slopes at the Jackpile mine are more gentle than surrounding terrain and, thus, fit into the general topography of the area. Physical and vegetative methods to stabilize these slopes are currently being implemented or being considered for pilot programs at the mine.

When available, large aggregates are deposited on dump slopes. Dumps L, K, and part of I have had large aggregates dumped on the slopes in 1978. Many shorter slopes have been reduced in angle to a more mild grade on Dumps L and parts of I (on the top of the dump). Benching has been used to control erosion on the slopes of Dumps I, $Y_2$ and L.

Slopes on Dumps L and K did not require surfacing due to the desirable soil on the slopes. The slopes of Dump I are being topdressed with 18 to 24 inches of favorable soil in order to improve conditions for revegetation.

Seeding (1978)

Eight native grass and shrub species compose the 1978-1979 seed mixture for reclamation sites at the Jackpile mine. This mixture will be drilled into reclamation sites at a rate of eight pounds per acre (Fig. 1).

Dumps O, P, $P_1$ and $P_2$ were reseeded in 1978. The dumps were reseeded with Blue Grama, Alkali Sacaton, Indian Ricegrass and Crested Wheatgrass.

Slope Stabilization Research Projects (1978)

The 1978 Seedling Transplant Project involved the use of Fourwing Saltbush (Atriplex Canescens) seedlings raised under greehouse conditions and transplanted onto Dump J slopes. Dump J's crust is composed of Tres Hermanos sandstone and displays no inhibitory problems. The program involves three phases: Phase I--shrub germination and growth; Phase II--planting of shrub seedlings; and, Phase III--monitoring of project progress and success.

Greenhouse seedlings were planted beginning in June, 1978. Approximately 500 seedlings were planted on the west face of Dump J and approximately 370 plants on the east slope. A total of 0.8 acres were transplanted. Following problem observation, modifications of the procedures were made to improve plant survival. The surviving seedlings will establish themselves as seed sources for the slope.

Slope revegetation of mine overburden dumps, using a power mulcher to propel native grasses and shrub seed onto slope surfaces, was attempted on a large scale during the 1978 summer planting season. The seed was mixed with barley straw (the transport media) and blown over the crest of the dump onto the slope. The seed and mulch was then worked into the slope surface. The success of this slope project will be monitored, documented and reported in subsequent annual reports.

| DUMPS | ACRES OF SLOPE PLANTED (1978) |
|---|---|
| J | 3.7 |
| C | 1.4 |
| D | 1.0 |
| E | 1.0 |
| F | 1.5 |
| G | 2.5 |

Success Rates on 1978 Reclamation Projects

Success rates of the Seedling Transplant Project were evaluated in October, 1978. The survey revealed that the seedlings planted on the windward slope (west side) had better survival rates than those of the lee slope (east side). Of the seedlings planted on the west slope, 24.9% survived. On the east slope, 370 shrubs were planted and 9.8% survived. Considering that the seedlings did not receive 14% moisture by weight in the soil, which is needed for optimum growth, the success rate was adequate for slope conditions.

Dumps O, P, $P_1$ and $P_2$ were reseeded following an inspection which determined that the grasses planted last year were not germinating as expected due to poor rainfall. Refer to the 1978 Seeding section for grass species.

Success Rates on Reclamation Work Prior to 1978

Foliage cover and density data collected on Dump S in October of 1977 revealed a total cover of 6.8% and a relative foliage cover for all planted species of 78.3%. Dump S, 15 months after seeding, had 57% of the foliage cover found in the surrounding rangeland.* Dumps C, D, E, F and G are also scheduled for reseeding in June of 1979, pending a final success survey in the spring. Fourwing Saltbush has been very successful on Dumps E, F and G, but limited stands of favorable grasses exist on the dump surfaces. All reclaimed dumps to date will be surveyed for success rates and density values in the summer or fall of 1979.

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* Kelly, E., Reynolds, J., and Potter, L., 1977 Revegetation of Overburden, Anaconda's Open Pit Uranium Mine.

FUTURE RECLAMATION SCHEDULE AND PRACTICES

1979 - 1985

| SCHEDULE* | LAND SURFACE FEATURE | ACTION | APPROX. ACRES |
|---|---|---|---|
| 1979 | Waste Dumps T, V, L, K, I, $Y_2$, a portion of X | Rip surface, seed, mulch and fertilize. | 170 |
| 1979 | C, D, E, F, G | Reseed, mulch and fertilize. | 164 |
| 1979-1981 | Waste Dumps H, U, A, B, W, N, Y | Topdress with materials from on-going stripping operations or top soil stockpiles. Prepare surface, lime if necessary, seed, mulch and fertilize. | 240 |
| 1976-1981 | Open Pits | Topdress and grade 100 acres of north Paguate Pit to flood plain level. Topdress remaining pit with materials from ongoing stripping operations, or top soil stockpiles. Lime if necessary, mulch, seed and fertilize. | 100 |
| 1982-1985 | Waste Dumps R, Q, North and South Dumps and Open Pits | Topdress pit areas with material from final stripping operations or top soil stockpiles. Lime if necessary, seed, mulch and fertilize. | 1,570 |
| 1982-1985 | Areas supporting ore stockpiles, other storage areas | Rip surface, seed, mulch and fertilize. Topdress if necessary. | 200 |
| After 1985 | Roads | Prepare surface, seed, mulch and fertilize. | 130 |
| After 1985 | Open Pits | Topdress pit areas with material from final stripping operations or top soil stockpiles. Lime if necessary, seed, mulch and fertilize. Fence high walls around open pits. | 570 |

* Provided that acreages are not completed on schedule, reclamation funds will be accrued for completion of designated work at a subsequent date.

## RECLAMATION WORK COMPLETED IN 1978

| YEAR RECLAIMED | SITE | ACREAGE | TYPE OF COVER | AMOUNT OF COVER | TECHNIQUE | WORK TO BE COMPLETED |
|---|---|---|---|---|---|---|
| 1978 | Dump K | 13 | Tres Hermanos sandstone | Existing material on dump | Graded surface. Construct erosion control system consisting of soil berms. Accumulate large rocks into piles. | To be seeded, mulched and fertilized in the summer of 1979 |
| 1978 | Dump L | 40 | Tres Hermanos sandstone and some shales | Existing material on dump. | Graded surface and constructed erosion control system consisting of soil berms. Reduced many slope angles. | To be seeded, mulched and fertilized in the summer of 1979 |
| 1978 | Dumps X, I & $Y_2$ (portion) | 70 | Tres Hermanos sandstone and some shales | Topdress, a cover depth of 18" to 24", is completed on the dump top surface. Cover material for the slopes has been hauled in and will be deposited after the first of the year. | Favorable soil material transported onto site to cover top surface and slopes. Grade surface, construct erosion control system consisting of soil berms, terraced slopes. | To be seeded, mulched and fertilized in the summer of 1979 |
| 1978 | Dumps O, P, $P_1$ & $P_2$ | 31 | Tres Hermanos sandstone | Existing material on dump. | Reseeded. Refer to 1978 seeding dump preparation completed in 1977 | Completed. No other action needed at present. |
| 1978 | Dump J | 0.8 (Slopes) | Tres Hermanos sandstone | Topdress 18" to 24" deep on top and slopes. | Transplanted Fourwing Saltbush seedlings on slopes. Refer to 1978 research projects. | Research project. Monitoring will continue to determine project success. |
| 1978 | Dumps J, C, D, E, F, & G. | 11.1 (slopes) | Tres Hermanos sandstone | Existing material on C, D, E, Dump slopes. Topdress 18" to 24" on J, F, G, Dump slopes. | Propelled seed onto slope surface and worked seed into soil. Areas also mulched. Refer to 1978 research projects. | Research project. Monitoring will continue to determine project success. |

NOTE:
1. Total approximate acreage--166.
2. Refer to the Surface Activity 1978 Map, Sheet 2, for site locations.
3. Investigations of Tres Hermanos sandstone reveal that it possesses the most favorable characheristics for plant establishment at the Jackpile Mine. The Tres Hermanos formation comprises the uppermost layer of the stratigraphis column and is aesthetically acceptable due to its brown color (Fig. 2).

## RECLAMATION SITES COMPLETED 1976 AND 1977

| YEAR RECLAIMED | SITE | ACREAGE | TYPE OF COVER | AMOUNT OF COVER | TECHNIQUE | WORK TO BE COMPLETED |
|---|---|---|---|---|---|---|
| 1977 | Dumps O,P,$P_1$ and $P_2$ | 31 | Tres Hermanos sandstone | Existing material on dumps | Graded and ripped top surface; constructed erosion control system consisting of soil berms, seeded, mulched and fertilized (Fig. 3). | Reseeded summer of 1978 |
| 1977 | Dump C | 17 | Tres Hermanos sandstone | Existing material on dump | Same as for Dumps O, P, $P_1$ and $P_2$. | To possibly be reseeded summer of 1979 |
| 1977 | Dump D | 15 | Tres Hermanos sandstone | Existing material on dump | Same as for Dumps O, P, $P_1$ and $P_2$. | Same as for Dump C |
| 1977 | Dump E | 11 | Tres Hermanos sandstone | Existing material on dump, portions cover with 18" to 24". | Same as for Dumps O, P, $P_1$ and $P_2$. | Same as for Dump C |
| 1977 | Dump F | 83 | Mixture of Tres Hermanos sandstone and some shale | Topdress 18" to 24" deep on top and slopes. | Favorable soil material transported onto site to cover top surface and slopes. Grade and rip top surface, construct erosion control system consisting of soil berms. Seed, mulch and fertilize (Fig. 3). | Same as for Dump C |
| 1977 | Dump G | 38 | Mixture of Tres Hermanos sandstone and some shale | Topdress 18" to 24" deep on top and slopes. | Same as for Dump F | Same as for Dump C |
| 1977 | Dump J | 13 | Tres Hermanos sandstone | Topdress 18" to 24" deep on top and slopes. | Same as for Dump F | Complete. No other action needed at present. |
| 1977 | Dump T | 26 | Tres Hermanos sandstone | Topdress 18" to 24" deep on top and slopes. | Same as for Dump F. | To be seeded, mulched and fertilized summer of 1979 |
| 1977 | Dump V (portion) | 21 | Tres Hermanos sandstone | Topdress 18" to 24" deep on top and slopes. | Same as for Dump F. | Same as for Dump T. |
| 1976 | Dump S | 72 | Tres Hermanos sandstone | Existing material on dump. | Crushed existing rock on surface to prepare seedbed 18" to 24" deep; graded top surface. Seeded, mulched & fertilized (Fig. 4). | Complete. Good success rates. No other action needed at present. |

NOTE: Refer to the Surface Activity 1978 Map, Sheet 2, for site locations.

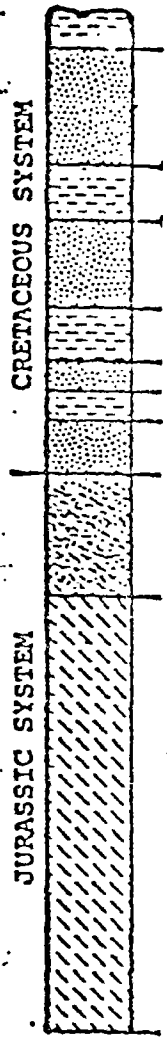
Figure 1.

SEED MIXTURES FOR 1978 AND 1979

| Genus & Species | Common Name | % of Mixture |
|---|---|---|
| Bouteloua gracilis | Blue Grama (Lovington) | 30 |
| Bouteloua curtipendulia | Sideoats Grama (Vaughn) | 10 |
| Oryzopsis hymenoides | Indian Ricegrass (Paloma) | 10 |
| Agropyron smithii | Western Wheatgrass | 10 |
| Atriplex canescens | Four-wing Saltbush | 5 |
| Sporoboius airoides | Alkali Sacaton | 15 |
| Eragratis curvula | Weeping Lovegrass | 15 |
| Melilotus officinales | Yellow Sweetclover | 5 |
| TOTAL | | 100% |

Figure 2.

TYPICAL STRATIGRAPHIC COLUMN




| FORMATION | UNIT | THICKNESS (feet) |
|---|---|---|
| MANCOS | | |
| DAKOTA | | |
| MANCOS | TRES HERMANOS | 180–450 |
| DAKOTA | | |
| MANCOS | | |
| DAKOTA | | |
| MANCOS | | |
| DAKOTA BED | | 50 |
| | JACKPILE BED | 0–220 |
| | BRUSHY BASIN | 250–350 |
| | WESTWATER CANYON | 0–50 |
| | RECAPTURE | 50–100 |
| MORRISON | | |

SOURCE: KITTEL, 1963

Figure 3.

SEED MIXTURES FOR 1977

| Genus & Species | Common Name | % of Mixture |
|---|---|---|
| Bouteloua gracilis | Blue Grama (Lovington) | 25 |
| Oryzopsis hymenoides | Indian Ricegrass (Paloma) | 10 |
| Atriplex Canescens | Four-wing Saltbush | 5 |
| Agropyron Disertar | Crested Wheatgrass (Nordan) | 15 |
| Sporobolus Airoides | Alkali Sacaton | 15 |
| Eragratis Curvula | Weeping Lovegrass | 15 |
| Sporobolus Crytandrus | Sand Dropseed | 10 |
| | White Clover | 5 |
| | Fall Barley | No Mixture Broadcast |
| | Four-wing (slopes) | No Mixture Broadcast |
| TOTAL | | 100% |